Writing to Learn

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 *ABSTRACT*

 *A recent guest comment is used as a vehicle to discuss the process of "writing to learn". In this context we discuss how writing can help students make the transition from their own models of the world to the viewpoints taught in the introductory physics course. Writing can also be used to get upper year students to focus on the conceptual underpinning of the course.*

 In a recent guest comment, Stephen Becker1 writes about "Teaching writing to teach Physics". It is gratifying to see a recognition of the importance of incorporating a writing component into regular physics courses; while the importance of using writing to engage the student with the material has long been used in Mathematics2,3, it has not with some exceptions4,5,6,7 been employed in physics. Becker's commendable plunge into the cutting edge of educational research has students using writing to report on "what they did in a lab or"... as a "discussion of some topic in the course". This is a good start, which can nevertheless be improved upon to produce critical self analysis by the student. If one reads Becker's article carefully, in the introductory scene, a student with a one-page synopsis of lab work in hand is being given the answer to the questions. As Barnes, Britton and Torbe address this issue in the book Language, the Learner, and the School,8 this use of writing leads to rote learning by the student; the student learns the teacher's expectations and learns what points should be delivered to the teacher (and ultimately on the exam) rather than engaging with the subject him/herself. It is for this reason that it is useful to enhance the use of writing in the course beyond the approach used by Becker.

 It is important in the introductory physics course for students to critically examine their view of the world. In the in-depth analyses of student attitudes undertaken by McDermott et al.9, Gunstone10, Halloun and Hestenes11 and Bowden et al.12, it is shown that students enter introductory courses with viewpoints differing significantly from the interpretation of how nature behaves that will be taught them and as they progress through the courses, these same students go to great lengths to maintain their original viewpoints. Writing in physics courses allows students to mediate their own "knowledge" with the new knowledge which the course presents to them. Writing to learn and learning to write explores the student’s own doubts, gaps in knowledge and gropings for the answer; only after the student has put something on paper does the professor respond.

 Aside from using the one page digest of the lab for a conference with the student, Becker lists one other pedagogical purpose; "To improve student writing: Working on a one-page summary of a lab or on a full lab report is good practice in writing-as good as working on an English essay. For example, the short lab summaries are excellent vehicles for dealing with sentence level and paragraph level issues and the longer lab reports are useful for working on large scale organizational problems." The impression that the reader may have on reading this second point is that the purpose of a university English composition course is to "deal with sentence level and paragraph level issues and ... organizational problems.". Composition courses teach students not to be receivers but to be constructive learners, how to write one's way to learning. Language skills are inextricably tied to the meaning, constructs and texts in a students repertoire. (McCormick13). Research on writing has postulated that such exercises as synopses do not require student investment. The material is there, and the student only has to reformat someone else’s (presumably an expert’s) work. Of more value is student response to readings which have been assigned and/or explorations of questions of interest or puzzlement to the student, articulated during the course. Physics journals and portfolios have been proven to work well in this context, particularly if they involve a component of peer critiquing. "In order for reflection to occur, the oral and written forms of language must pass back and forth between persons who both speak and listen or read and write - sharing, expanding and reflecting on each other's experiences." (Belenkey14)

 Courses which include writing include some conferencing with the instructor. The student in a large introductory physics course facing a three minute conversation with the “expert”; finds the time passing in a flash and the reader may ask what issues has the student been able to cover, especially with his/her desperate sense of time ticking on relentlessly? Prewriting, drafting, and rewriting are integral to any successful piece of writing; what is so often not taken into account is that one never can “get it right” the first time that one puts pen to paper. Writing is a recursive process, one that goes backward and forward and backward again, from jotting down initial conceptions to drafting the work to regeneration of new ideas and new formats. This is precisely what William Mullin describes4 in the use of writing at the University of Massachusetts Amherst. "Students first take a standard freshman-level course given by the English department". In addition students take a course Physics 381 "Writing in Physics". As in all such departmental courses at the University of Massachusetts, proven techniques for writing, which the student had encountered in the English departmental freshman-level course are incorporated into the "Writing in Physics" course. "Among these are frequent short assignments, instructor feedback, revision, peer review and reading assignments of articles by good writers in the subject area of the course." If writing is required of any student in any discipline, multiple and opportunities to discuss work with instructors and peers, and to reevaluate and rewrite one’s initial work is crucial to the success of the project and to the development of the student’s sense of him/herself as both a writer and a member of his/her discipline.

 At Concordia university we use writing to ensure that students are aware of the concepts underlying the topics being discussed, rather than viewing the material as an agglomeration of disembodied facts and formulae to be learned. In physics courses, students have to freewrite in their journals about material before the class with the result that a typical "C" student is able to analyze material by developing questions and answering her/his own questions before the class; these students write their way into an understanding of difficult concepts which they had not grasped before. Students produce a presummary based on the ideas they develop in the course of their freewritings as well as writing a postsummary based on the concepts the students have come to understand after the week's classes. In smaller, upper year courses, the full recursive and interactive approach to writing is employed by means of a course dossier:

At the end of course, these  **s**tudents collect a sample of 8 or more postsummaries and write a single overview using the following procedure:

*First entries*: two friends read the material the student collected and make comments.

*Second entries*: the student rereads the material and writes freely about it.

*Third entries*: The second entries are used to develop some common theme(s) that run through the work.

*Fourth entries:* The themes are developed into a draft of an *overview*.

*Fifth entries:* the two friends read the draft and record their comments.

*Final entries:* the draft is revised into an overview of the course. Suggested length three pages, but there is no page limit.

 One student, who wrote a course dossier in the fall semester and began graduate work at another university in January took time after leaving our physics department to write about his experience.15 This student who had just completed his final semester at Concordia with a GPA of 3.75 wrote that the course he had taken in his final semester "is definitely one course that I will remember." He valued the course not only for teaching him electromagnetic theory, but also because it "taught me how to think." The student stated that "the post-summaries and the POST post summary (the course dossier) . . . served two purposes. They allowed us to think on what had been presented in a critical manner and they made us translate our thoughts to paper in a clear manner. I believe that these two items can't be separated from each other. It doesn't matter how well one understands the material if one is not able to transmit the 'digested' ideas. I don't think that one could present ideas clearly without a thorough understanding of such ideas; so in a sense I think that the two items are really one."

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 FOOTNOTES & REFERENCES

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15 The student from Columbia would like his origin noted. He mentions that "If we are fortunate people think of Columbia as a coffee producer, but most of the time the Columbia fame lies in drug trafficking." Saying he is from Columbia "will be a way of showing that Columbia is more than drugs and coffee.